MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

SUPPLEMENTARY EXAMINATION

TRIMESTER 1, 2015/2016

ECE3266 – DIGITAL AUDIO SIGNAL PROCESSING

(All sections/ME)

19 NOV 2015
2.30 PM – 4.30 PM
(2 HOURS)

INSTRUCTION TO STUDENT

1. This question paper consists of 6 questions on 5 pages.
2. Attempt **ALL** the questions in this paper.
3. The total number of marks for this paper is 60. The marks allocated for each question is given.
4. Please write all your answers in the answer booklet provided. Clearly number your answers.

Question 1

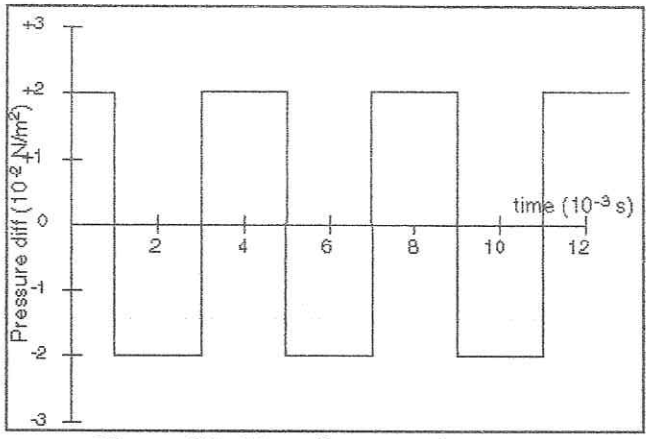

Figure Q1: Plot of rectangular wave.

(a) Figure Q1 shows a rectangular wave plot. From this figure:
   (i) Calculate the period and fundamental frequency of the wave.
   (ii) List the frequencies of the first four elements of the harmonic series of pure tones that can be used to represent this wave.
   (iii) Is this a pure tone or a complex tone? Explain your answer.

[2 + 2 + 2 = 6 marks]

(b) A motorcycle traveling north produces a sound pressure level of 77 dB when measured from the pavement. Also when measured from the pavement, two identical cars traveling together south produce a sound pressure level of 80 dB in total.
   (i) What is the sound intensity of a single car?
   (ii) What is the resultant sound pressure level of all the vehicles when they pass each other?

[2 + 2 = 4 marks]

Question 2

(a) Explain the following two phenomenon associated with sound waves:
   (i) Doppler effect
   (ii) Shockwave

[3 + 3 = 6 marks]

Continued .....

(b) Assume that the sound level of a playing guitar, bass, and drum is 80 dB each at your ears.

(i) Compute the total sound pressure level of a band playing 2 guitars, a bass and a drum.

(ii) One of your friends is seating at a location twice the distance between you and the band. Compute the total sound pressure level at his position for the same situation as in (i).

[2 + 2 = 4 marks]

Question 3

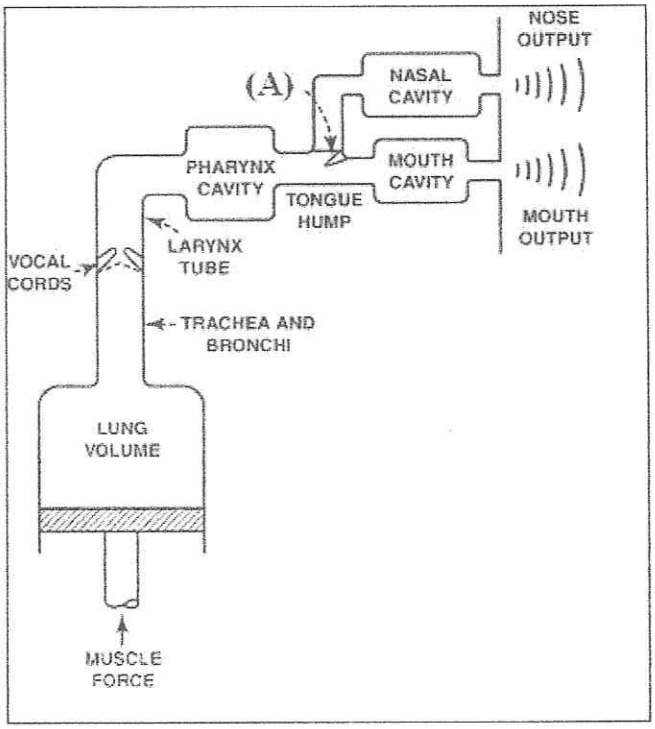

Figure Q3: Schematic diagram of the speech production system.

Figure Q3 shows a simplified version of the human speech production mechanism.

(a) Referring to this diagram, what is the name of the articulator labeled (A) and what is its main function? What are the other three articulators other than (A) and what are their roles in speech?

[5 marks]

Continued .....

(b) Where is the glottis located?

[1 mark]

(c) What are the two types of excitation sources for the vocal tract? Explain how each one is formed.

[4 marks]

Question 4

(a) Figure Q4 shows the diagram of a basic MPEG Audio encoder. Briefly describe all the steps involved.

[8 marks]

(b) Layer I architecture codes audio in frames of 384 audio samples (12 samples per subband), while Layer 2 and 3 use 1152 samples per frame (3 groups of 12 samples per subband). Give **two (2)** advantages of using 1152 samples over 384 samples per frame.

[2 marks]

Question 5

(a) Describe **three (3)** current challenges related to the spoken speech itself that speech scientists are still facing with modern speech recognition systems.

[6 marks]

(b) Mr Dudley is creating an automatic word recognition system for an electronic children's book. The child would read into a microphone and the system would reply with a "correct" or "wrong" answer.

(i) Which speech recognition system is most suitable for this application? Describe your reasons.

(ii) Proceed to describe how the system you mentioned in (i) works.

[2 + 2 = 4 marks]

Continued .....

Question 6

(a) Briefly describe the following speech synthesis techniques:
(i) Synthesis based on waveform concatenation
(ii) Synthesis by rule

[3 + 3 = 6 marks]

(b) Table Q6 compares three different speech synthesis techniques. Provide the answers for (i) to (viii) of Table Q6.

[4 marks]

Table Q6

Features		***Waveform Concatenation***	***Analysis - Synthesis Method***	***Synthesis by Rule***
Quality	***Intelligibility***	High	(i)	(ii)
	Naturalness	(iii)	Medium	(iv)
Bit rate		24-64 kbps	(v)	50-75 bps
Complexity		(vi)	Medium	(vii)
Main Hardware		Memory	(viii)	Processor

End of Paper